M.I.R.L.
REPORT NO. 21

WASHABILITY CHARACTERISTICS OF LOW-VOLATILE BITUMINOUS COAL FROM BERING RIVER FIELD, ALASKA

by
P. DHARMA RAO

Mineral Industry Research Laboratory
University of Alaska
College, Alaska 99701

FEBRUARY 1969

M.I.R.L.
Report No. 21

WASHABILITY CHARACTERISTICS OF LOW-VOLATILE BITUMINOUS COAL FROM BERING RIVER FIELD, ALASKA

by

P. Dharma Rao

Mineral Industry Research Laboratory
University of Alaska
College, Alaska 99701

February 1969

ACKNOWLEDGMENTS

The author wishes to express his gratitude to Cortella Coal Corporation for supplying the coal samples used in this study.

Thanks are due to Dr. Donald J. Cook, Head, Department of Mineral Engineering and Earl H. Beistline, Dean, College of Earth Sciences and Mineral Industry for their guidance and direction.

ABSTRACT

Two samples of low-volatile bituminous coal from Bering River Coal Field were sized to 0.525" x 3, 3 x 6, 6 x 10, 10 x 20, and 20 x 35 mesh and their washability characteristics studied at specific gravities ranging from 1.29 to 1.55. The results showed that the coals can be up-graded to an ash content as low as 2% with conventional cyclone heavy media process. A product containing less than 1% ash can be obtained from these coals with surprisingly high yields, ranging from 50 to 95% depending on the ash content desired in the washed coal, and the characteristics of the raw coal.

The experimental work proves the technical feasibility of preparation of the coal for metallurgical use and as low ash carbon raw material. Further Pilot Plant testing would be required in the fields of preparation and utilization in order to design the final plant for ascertaining the economic feasibility.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF TABLES (Cont.)

LIST OF FIGURES

INTRODUCTION

Coal bearing formations in Bering River Coal Field are known to extend in an almost continuous belt in excess of a 50 square mile area.[1] The coal varies in rank from low-volatile bituminous to semi-anthracite and anthracite. Although the field has been prospected on surface and under-ground, no commerical exploitation has been done. Accurate estimates of the reserves are not available due to complex structure of the region and lack of thorough subsurface exploration.

Cortella Coal Corporation of Cordova has recently launched a drilling program with a view of assessing the quality and extent reserves for foreign markets. Two of the samples obtained during their exploration program were sent to the Mineral Industry Research Laboratory for washability studies. The samples investigated represent a very limited portion of the Bering River Coal Field and the results, therefore, do not reflect the characteristics of the entire deposit.

SAMPLING AND SAMPLE PREPARATION

Sample Location

The sample designated as Leeper Creek No. 1 was a drill sample at 800 foot level from Section 21, T17S, R7E, NE 1/4 of Cordova (8-1) Quadrangle. The sample designated as Leeper Creek No. 2 was collected in a seemingly unweathered portion of a stripped seam at a depth of 14 feet from Section 15, T17S, R17E, SW 1/4, adjacent to the common corners of Sections 21, 22, 15, and 16 of Cordova (8-1) Quadrangle.

Sample Preparation

The samples received were mostly minus 1" with a small portion coarser than 1/2". The samples were screened on 0.525" screen and the oversize was crushed to pass the screen. Twenty pounds of each of the samples were screened on 3, 6, 10, 20, 35, and 200 mesh Tyler screens. The size distribution and analysis of the sized fractions is presented in Tables 1 and 2. For the size fractions used in washability studies, the reported ash value is calculated by reassembling all the gravimetric fractions. The ash content of 35 x 200 and -200 mesh fractions were, however, obtained by direct analysis.

WASHABILITY STUDIES

The sized 0.525" x 3, 3 x 6, 6 x 10, 10 x 20, and 20 x 35 mesh fractions were used in washability studies. Separations were made at 1.290, 1.300, 1.325, 1.375, 1.400, 1.450, 1.500 and 1.550 specific gravities, using mixtures of carbon tetrachloride and benzene as heavy liquid. Since the quantity of sinks obtained at 1.55 Sp.G. was small, no separations were made at higher specific gravities. The washability data of the various sized fractions are presented in Tables 3 to 8 for Leeper Creek No. 1, and Tables 9 to 14 for Leeper Creek No. 2. Figures 1 to 14 show washability curves for Leeper Creek No. 1 and No. 2.

Raw coal samples and 1.29 Sp.G. floats of composite 0.525" x 35 mesh products were analyzed for ash, sulfur, volatile matter, heating value and free swelling index.

DISCUSSION OF RESULTS

Washability Characteristics

The results show that the coals can be washed to an ash content as low as 2% using conventional heavy media cyclone process. Figure 6 shows the washability characteristics of recombined 0.525" x 35 mesh Leeper Creek No. 1 coal. It may be noted from the curves that the yield of clean coal, containing 2% ash, will be 90% (cumulative float ash curve). The sinks will analyze 32.8% ash (cumulative sink ash curve). The highest ash in any single particle will be 10% (elementary ash curve). The coal will have to be washed at a theoretical gravity of 1.364 (specific gravity curve). The $\pm$ 0.025 Sp. G. near gravity material will be 6.5% ($\pm$ 0.025 Sp. G. distribution curve). However, in a product containing 1% ash the predicted results would be: 64% yield of clean coal, 12.3% ash in sinks, separating gravity 1.297 with $\pm$ 0.025 near gravity material in excess of 80%.

Figure 12 shows the washability characteristics of combined 0.525" x 35 mesh Leeper Creek No. 2 coal. For clean coal containing 1% ash, the curves show 96.4% yield, 33% ash in sinks, 1.336 separating gravity at $\pm$ 0.025 near gravity material of 2.6%.

These coals seem to offer additional possibility of amenability

to the production of ultra clean coal containing less than 1% ash. The theoretical yield and ash content that can be expected at 1.29 Sp.G. separation for 0.525" x 35 mesh coal will be:

Coal	Ash, %	Yield, %
Leeper Creek No. 1	0.83	53.25
Leeper Creek No. 2	0.74	64.83

It would be of interest to note that the coals can be considered as unique in their amenability to production of ultra clean coal at a size as coarse as 0.525" coupled with high yields.

The washability data show a slight but insignificant reduction in near gravity material with decrease in size coal. There is, however, a very significant decrease in ash content for smaller size floats. The 1.29 Sp.G. floats for Leeper Creek No. 1 gave 0.95% ash for 0.525" x 3 mesh fraction and the ash content decreased to 0.63% for 20 x 35 mesh coal. Leeper Creek No. 2, however, gave 0.84% ash for 0.525" x 3 mesh fraction and the ash decreased to 0.65% for 20 x 35 mesh coal. It is, therefore, possible to obtain a lower overall ash content in clean coal when the raw coal is washed at a finer size. Although no testing was done for minus 35 mesh coal, flotation could yield a clean coal with much lower ash than attainable by heavy media process.

Coking Characteristics

Table 15 shows the proximate analysis of raw coal and 1.29 Sp.G. floats. Both coals fall in low-volatile bituminous rank. Leeper Creek No. 1 coal gave a free swelling index of 2½ compared to an index of 2 for Leeper Creek No. 2. In both cases, the free swelling was higher for 1.29 Sp.G. floats giving 3½ for Leeper Creek No. 1 and 3 for Leeper Creek No. 2 showing that washing can improve the swelling characteristics. The improvement will probably be less pronounced when washed at a higher specific gravity.

MARKET POTENTIAL

As Raw Material for Metallurgical Coke

From the foregoing study it is concluded that the coals tested can readily be washed to meet the specification of a metallurgical coal and can possibly make an excellent blending coal. Additional pilot plant coking tests would be required for a characterization of the resultant coke.

As Low Ash Coal

The possibility of preparation of ultra clean coal from the Bering River coals, could open new potential markets as low ash coal.[2,5] Battelle Memorial Institute, under contract from the Office of Coal Research, has completed a study on the potential market for low ash coal, prepared by Spencer Solvent Process.[3,4] Their finding would apply equally well in the present context. A brief review of potential markets for low ash coal is given below. No attempt is made to establish the commerical feasibility of preparation of low ash coal from the coals tested nor the suitability of such low ash coal for the markets reviewed herein. Only pilot plant testing in both the above fields can establish the economic feasibility for such

potential markets.

Carbon Electrode Raw Material: Largest potential market for low ash coal appears to be as a raw material in the manufacture of carbon electrodes and graphite, for the aluminum industry in particular. This requirement is presently met by petroleum coke. The ever increasing demand for carbon filler material by the aluminum industry and decreasing quantities of residual stock produced by the petroleum refineries represents a step in the direction of possible potential market for low ash coal to fill the gap. Considering the total potential market for carbon filler material as potential market for low ash coal, the tonnages estimated by Battelle Memorial Institute[4] are:

1970	2,150,000 Tons
1975	3,680,000 Tons
1980	3,220,000 Tons

The possible reaction of producers of petroleum coke and the possibility of reduced prices of their products due to competition of coal has not been determined.

Foreign Market: Low ash coal may be considered very favorably by the pollution conscious foreign buyers. Further, lower shipping costs on Btu basis for low ash coal could make it more attractive. The foreign market might thus constitute one of the largest single outlet for low ash coal.

Miscellaneous Potential Markets: Looking into the long range future, the potential markets for low ash coal could be gas turbine fuel, electric power generation, carbon black manufacture, blends with diesel oil for locomotives, low ash metallurgical coke, magneto-hydrodynamic power generation, and fuel cells. Some of these possibilities, although proven technically feasible, need to be evaluated from the aspect of the economics of utilization in each potential market.

CONCLUSIONS AND RECOMMENDATIONS

Conclusions

The coals studied can be washed to obtain a product containing as low as 2.0% ash using conventional cyclone heavy media process. Further reduction to less than 1% is possible with recoveries as high as 50 to 95%. A review of literature indicates potential markets for such low ash coal. Pilot Plant studies of preparation and utilization are required for an evaluation of economics. Float fractions obtained at 1.29 Sp.G. showed definite improvement in free swelling index over the raw coals which would be advantageous in marketing washed coals for metallurgical use.

Recommendations

The following are recommendations for further research on the utilization of Bering River coals:

1. Bench scale coking tests be conducted with washed coals to determine the resultant coke quality and tests with blends with other coals if further improvement is needed.
2. Pilot Plant tests using heavy media cyclone and flotation process to determine practical limits of reduction in ash

for use as low ash coal.

3. Tests to be conducted on prepared low ash coal for use in the manufacture of carbon electrodes for the production of aluminum and in other potential markets. Only such testing can determine the economics of utilization of these coals for such applications.

REFERENCES

1. Barnes, F. F., "Coal Resources of Alaska," Geological Survey Bulletin 1242-B, 1967.

2. Campbell, R. J. Jr., Hilton, R. J., and Boyd, C. L., "Coal as a Source of Electrode Carbon in Aluminum Production," Bureau of Mines Report of Investigations 5191, February 1956.

3. Kloepper, D. L., et.al, "Solvent Processing of Coal to Produce De-Ashed Product," Research and Development Report No. 9, submitted by Spencer Chemical Division to Office of Coal Research, U.S. Dept. of Interior.

4. Nelson, H. W., Hein, G. M., and Hazard, H. R., "Assessment of Potential Markets for Low-Ash Coal," Report submitted by Battelle Memorial Institute to Office of Coal Research, U.S. Dept. of Interior, December 1964.

5. Sanner, W. S., "The Preparation of Low-Ash-Content Anthracite," Preprint, Presented at AIME Annual Meeting, February 1968.

TABLE 1

SIZE ANALYSIS AND ASH DISTRIBUTION FOR
LEEPER CREEK NO. 1 RAW COAL, BERING RIVER FIELD

Screen Size, Mesh		Reassembled Products		Cumulative Retained		Cumulative Passing	
Passing	Retained	Wt., %	Ash, %	Wt., %	Ash, %	Wt., %	Ash, %
0.525"	3	25.59	3.45	25.59	3.45	100.00	5.41
3	6	26.44	4.29	52.03	3.88	74.41	6.09
6	10	18.18	5.92	70.21	4.41	47.97	7.08
10	20	11.75	7.22	81.96	4.81	29.79	7.78
20	35	7.75	8.15	89.71	5.10	18.04	8.15
35	200	6.98	8.59	96.69	5.35	10.29	8.14
200	Pan	3.31	7.20	100.00	5.41	3.31	7.20
Total		100.00	5.41				

TABLE 2

SIZE ANALYSIS AND ASH DISTRIBUTION FOR
LEEPER CREEK NO. 2 RAW COAL, BERING RIVER FIELD

Screen Size, Mesh		Reassembled Products		Cumulative Retained		Cumulative Passing	
Passing	Retained	Wt., %	Ash, %	Wt., %	Ash, %	Wt., %	Ash, %
0.525"	3	17.53	2.05	17.53	2.05	100.00	2.82
3	6	23.09	2.10	40.62	2.08	82.47	2.99
6	10	21.03	2.42	61.65	2.19	59.38	3.33
10	20	15.16	3.29	76.81	2.41	38.35	3.83
20	35	10.66	4.22	87.47	2.63	23.19	4.19
35	200	9.16	4.16	96.63	2.78	12.53	4.16
200	Pan	3.37	4.15	100.00	2.82	3.37	4.15
Total		100.00	2.82				

TABLE 3

SINK-FLOAT RESULTS OF 0.525" x 3 MESH SIZE COAL,
LEEPER CREEK NO. 1, BERING RIVER FIELD
(25.59% of Raw Coal)

Specific Gravity		Actual Products		Cumulative Float		Cumulative Sink		±0.025 Sp. G.
Sink	Float	Wt., %	Ash, %	Wt., %	Ash, %	Wt., %	Ash, %	Material, %
	1.290	61.18	0.95	61.18	0.95	100.00	3.45	
1.290	1.300	6.66	2.02	67.84	1.06	38.82	7.38	85.44
1.300	1.325	17.60	3.02	85.44	1.46	32.16	8.49	24.53
1.325	1.350	6.93	6.79	92.37	1.86	14.56	15.10	10.34
1.350	1.375	3.41	9.98	95.78	2.15	7.63	22.65	5.00
1.375	1.400	1.59	12.56	97.37	2.32	4.22	32.89	1.69
1.400	1.450	0.19	14.19	97.56	2.34	2.63	45.18	
1.450	1.500	0.13	18.92	97.69	2.36	2.44	47.61	
1.500	1.550	0.13	25.63	97.82	2.40	2.31	49.22	
1.550	I	2.18	50.61	100.00	3.45	2.18	50.61	
Total		100.00	3.45					

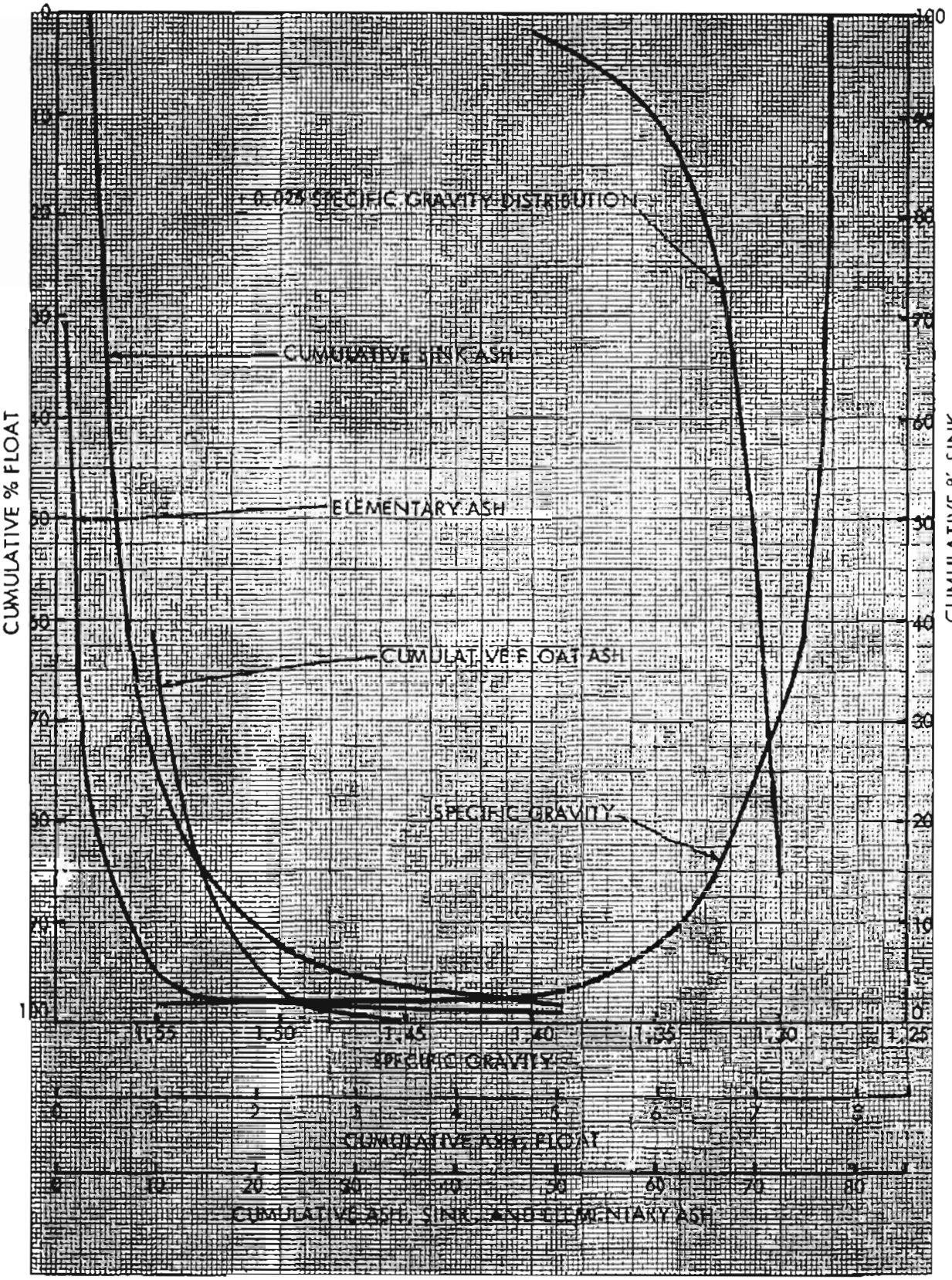

FIGURE 1 - WASHABILITY CHARACTERISTICS OF 0.525" x 3 MESH SIZE COAL, LEEPER CREEK NO. 1, BERING RIVER FIELD

TABLE 4

SINK-FLOAT RESULTS OF 3 x 6 MESH SIZE COAL,
LEEPER CREEK NO. 1, BERING RIVER FIELD
(26.44% of Raw Coal)

Specific Gravity		Actual Products		Cumulative Float		Cumulative Sink		+0.025 Sp. G.
Sink	Float	Wt., %	Ash, %	Wt., %	Ash, %	Wt., %	Ash, %	Material, %
	1.290	53.56	0.82	53.56	0.82	100.00	4.29	
1.290	1.300	14.76	1.97	68.32	1.07	46.44	8.29	85.00
1.300	1.325	16.68	3.52	85.00	1.55	31.68	11.23	22.59
1.325	1.350	5.91	6.86	90.91	1.89	15.00	19.80	8.19
1.350	1.375	2.28	10.00	93.19	2.09	9.09	28.22	3.79
1.375	1.400	1.51	12.53	94.70	2.26	6.81	34.32	1.83
1.400	1.450	0.64	16.36	95.34	2.35	5.30	40.53	-
1.450	1.500	0.35	21.27	95.69	2.42	4.66	43.85	-
1.500	1.550	0.34	27.21	96.03	2.51	4.31	45.67	-
1.550		3.97	47.25	100.00	4.29	3.97	47.25	-
Total		100.00	4.29					

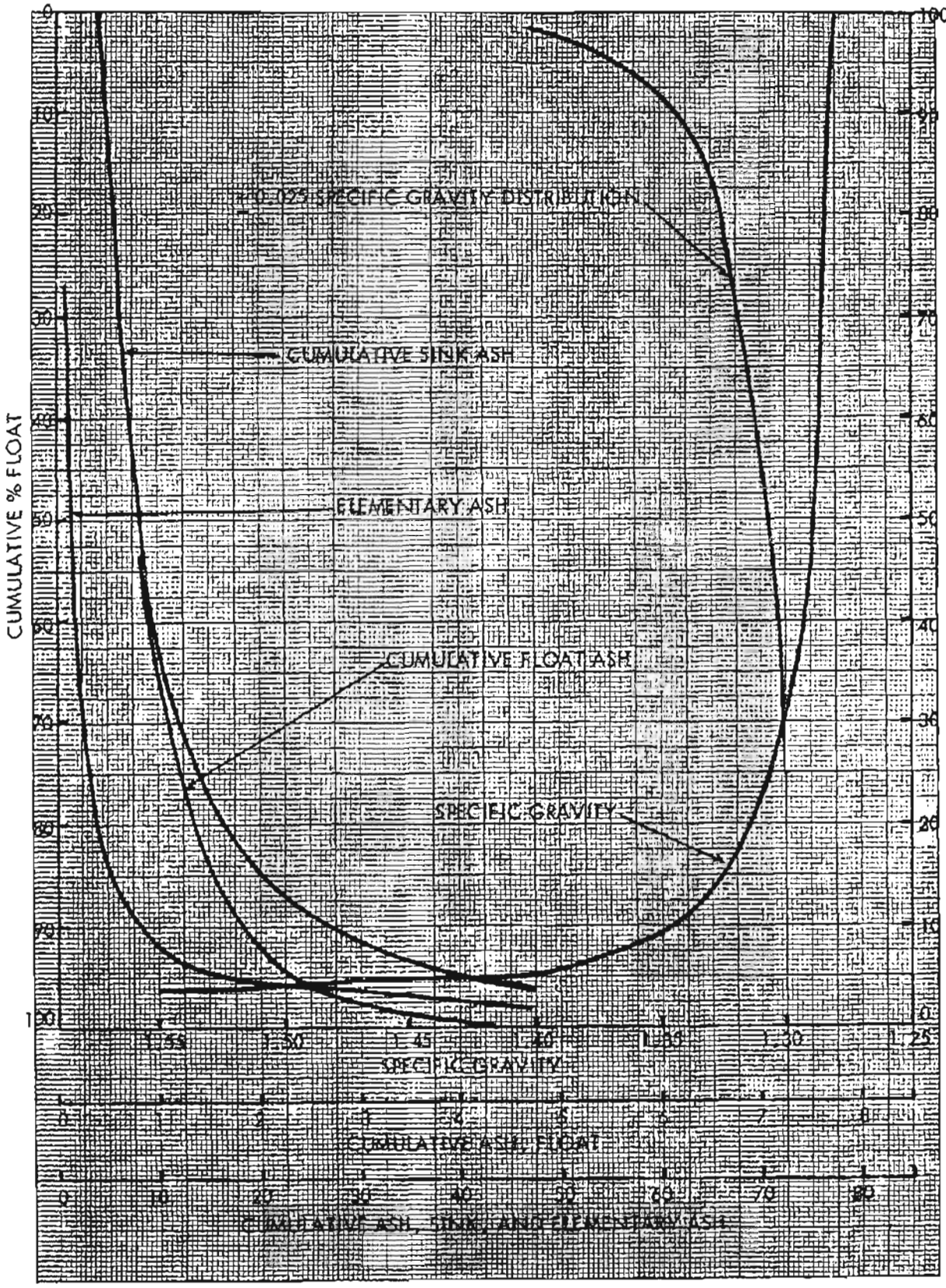

FIGURE 2 - WASHABILITY CHARACTERISTICS OF 3 x 6 MESH SIZE COAL, LEEPER CREEK NO. 1, BERING RIVER FIELD

TABLE 5

SINK-FLOAT RESULTS OF 6 x 10 MESH SIZE COAL,
LEEPER CREEK NO. 1, BERING RIVER FIELD
(18.18% of Raw Coal)

Specific Gravity		Actual Products		Cumulative Float		Cumulative Sink		+0.025 Sp. G.
Sink	Float	Wt., %	Ash, %	Wt., %	Ash, %	Wt., %	Ash, %	Material, %
	1.290	49.07	0.78	49.07	0.78	100.00	5.92	
1.290	1.300	18.58	2.03	67.65	1.12	50.93	10.87	80.62
1.300	1.325	12.97	3.86	80.62	1.56	32.35	15.95	18.01
1.325	1.350	5.04	6.78	85.66	1.87	19.38	24.04	7.94
1.350	1.375	2.90	9.63	88.56	2.12	14.34	30.11	4.87
1.375	1.400	1.97	12.40	90.53	2.35	11.44	35.30	2.57
1.400	1.450	1.21	16.64	91.74	2.54	9.47	40.06	-
1.450	1.500	0.72	22.02	92.46	2.69	8.26	43.45	-
1.500	1.550	0.72	26.99	93.18	2.88	7.54	45.54	-
1.550		6.82	47.50	100.00	5.92	6.82	47.50	-
Total		100.00	5.92					

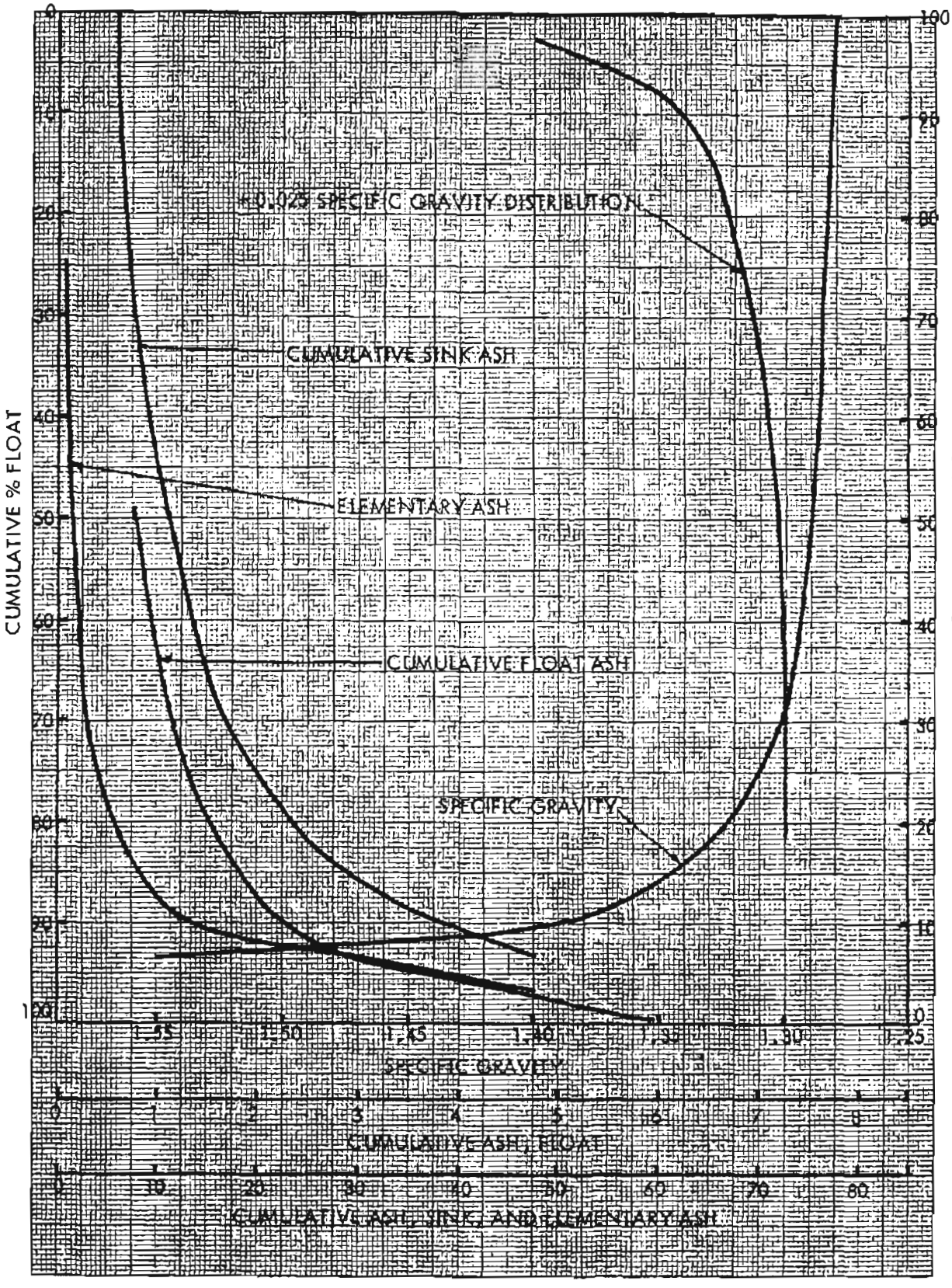

FIGURE 3 - WASHABILITY CHARACTERISTICS OF 6 x 10 MESH SIZE COAL, LEEPER CREEK NO. 1, BERING RIVER FIELD

TABLE 6

SINK-FLOAT RESULTS OF 10 x 20 MESH SIZE COAL,
LEEPER CREEK NO. 1, BERING RIVER FIELD
(11.75% of Raw Coal)

Specific Gravity		Actual Products		Cumulative Float		Cumulative Sink		+0.025 Sp.G.
Sink	Float	Wt., %	Ash, %	Wt., %	Ash, %	Wt., %	Ash, %	Material, %
	1.290	47.69	0.70	47.69	0.70	100.00	7.22	
1.290	1.300	14.93	2.07	62.62	1.03	52.31	13.17	76.61
1.300	1.325	13.99	3.78	76.61	1.53	37.38	18.02	18.85
1.325	1.350	4.86	6.74	81.47	1.84	23.39	25.88	8.70
1.350	1.375	3.84	9.80	85.31	2.20	18.53	30.89	5.57
1.375	1.400	1.73	13.25	87.04	2.42	14.69	36.41	2.49
1.400	1.450	1.52	17.20	88.56	2.67	12.96	39.49	-
1.450	1.500	1.17	22.30	89.73	2.93	11.44	42.46	-
1.500	1.550	1.29	27.27	91.02	3.27	10.27	44.75	-
1.550		8.98	47.27	100.00	7.22	8.98	47.27	-
Total		100.00	7.22					

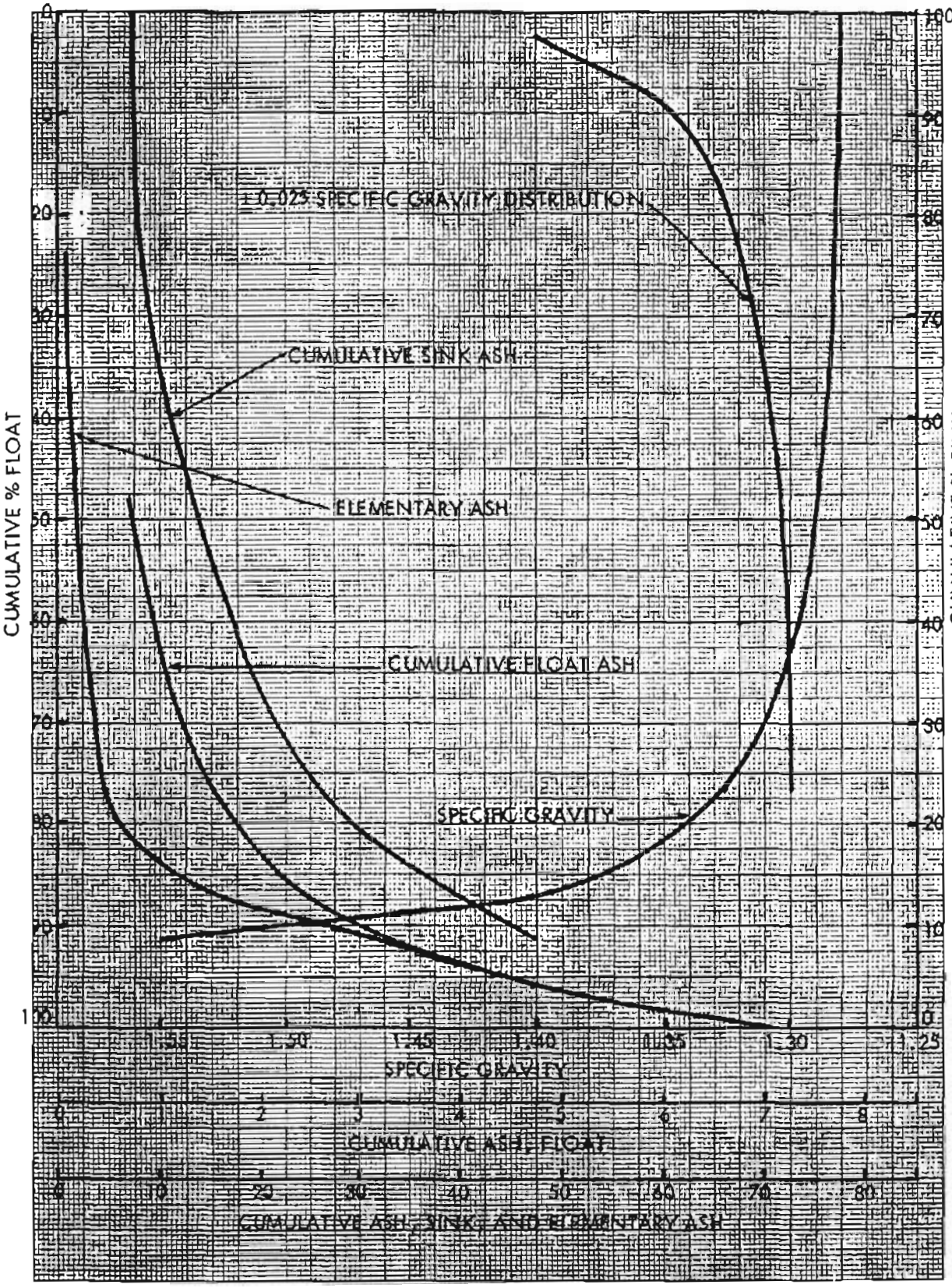

FIGURE 4 - WASHABILITY CHARACTERISTICS OF 10 x 20 MESH SIZE COAL, LEEPER CREEK NO. 1, BERING RIVER FIELD

TABLE 7

SINK-FLOAT RESULTS OF 20 x 35 MESH SIZE COAL,
LEEPER CREEK NO. 1, BERING RIVER FIELD
(7.75% of Raw Coal)

Specific Gravity		Actual Products		Cumulative Float		Cumulative Sink		+0.025 Sp. G
Sink	Float	Wt., %	Ash, %	Wt., %	Ash, %	Wt., %	Ash, %	Material, %
	1.290	44.27	0.63	44.27	0.63	100.00	8.15	
1.290	1.300	17.78	1.91	62.05	1.00	55.73	14.13	75.03
1.300	1.325	12.98	3.78	75.03	1.48	37.95	19.85	18.01
1.325	1.350	5.03	6.92	80.06	1.82	24.97	28.21	7.75
1.350	1.375	2.72	10.16	82.78	2.09	19.94	33.58	4.59
1.375	1.400	1.87	13.25	84.65	2.34	17.22	37.29	2.87
1.400	1.450	1.99	17.11	86.64	2.68	15.35	40.22	-
1.450	1.500	1.46	22.82	88.10	3.01	13.36	43.66	-
1.500	1.550	1.34	27.67	89.44	3.38	11.90	46.21	-
1.550		10.56	48.57	100.00	8.15	10.56	48.57	-
Total		100.00	8.15					

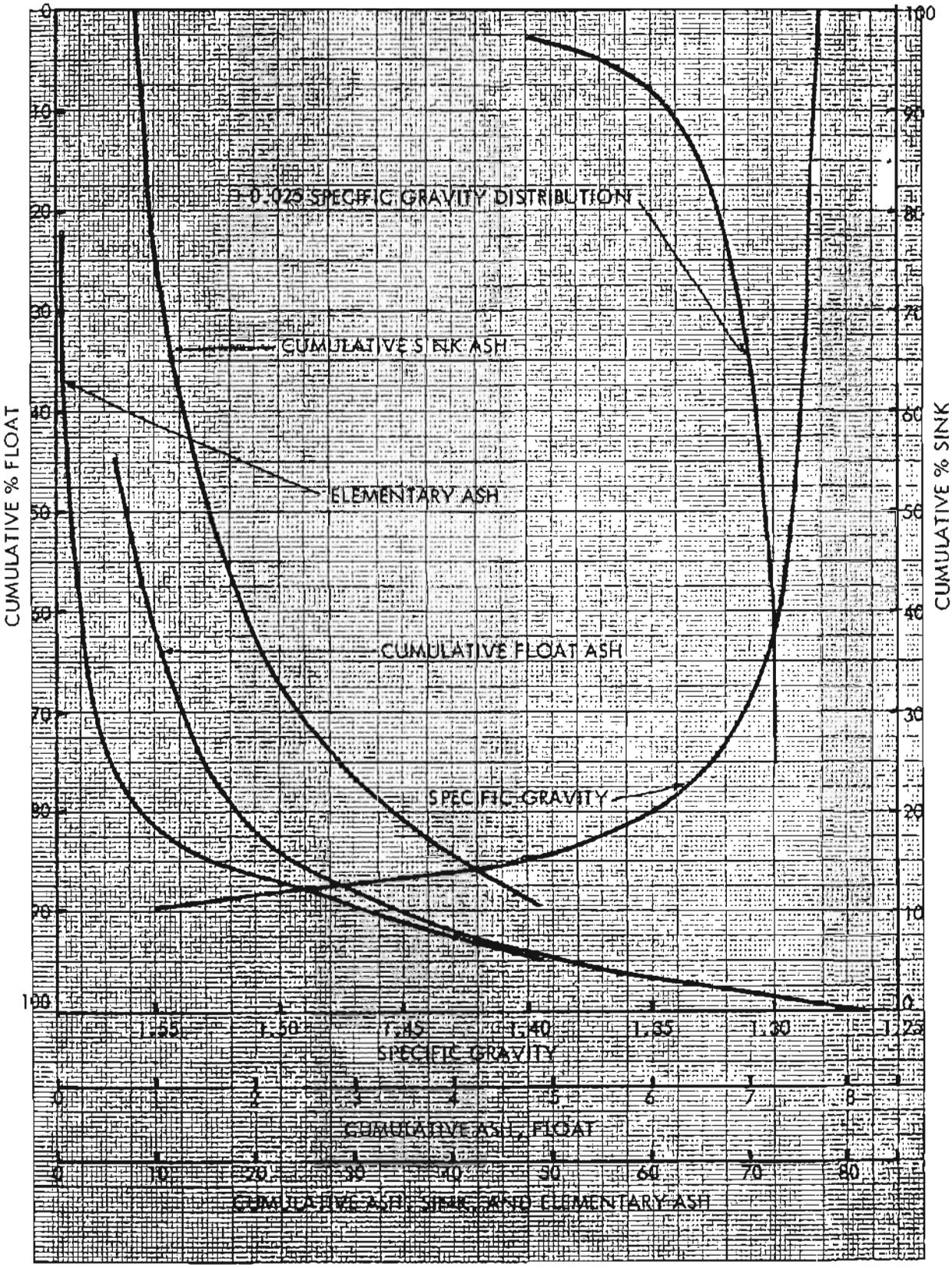

FIGURE 5 - WASHABILITY CHARACTERISTICS OF 20 x 35 MESH SIZE COAL, LEEPER CREEK NO. 1, BERING RIVER FIELD

TABLE 8

SINK-FLOAT RESULTS OF 0.525" x 35 MESH SIZE COAL,
LEEPER CREEK NO. 1, BERING RIVER FIELD
(89.71% of Raw Coal)

Specific Gravity		Actual Products		Cumulative Float		Cumulative Sink		+0.025 Sp. G.
Sink	Float	Wt., %	Ash, %	Wt., %	Ash, %	Wt., %	Ash, %	Material, %
	1.290	53.25	0.83	53.25	0.83	100.00	5.10	
1.290	1.300	13.51	2.00	66.76	1.06	46.75	9.96	82.28
1.300	1.325	15.52	3.47	82.28	1.52	33.24	13.20	21.33
1.325	1.350	5.81	6.81	88.09	1.87	17.72	21.72	8.78
1.350	1.375	2.97	9.90	91.06	2.13	11.91	28.99	4.61
1.375	1.400	1.64	12.67	92.75	2.32	8.94	35.33	2.07
1.400	1.450	0.86	16.67	93.61	2.45	7.25	40.59	-
1.450	1.500	0.56	21.94	94.17	2.57	6.39	43.81	-
1.500	1.550	0.57	27.16	94.74	2.72	5.83	45.93	-
1.550		5.26	47.64	100.00	5.10	5.26	47.64	-
Total		100.00	5.10					

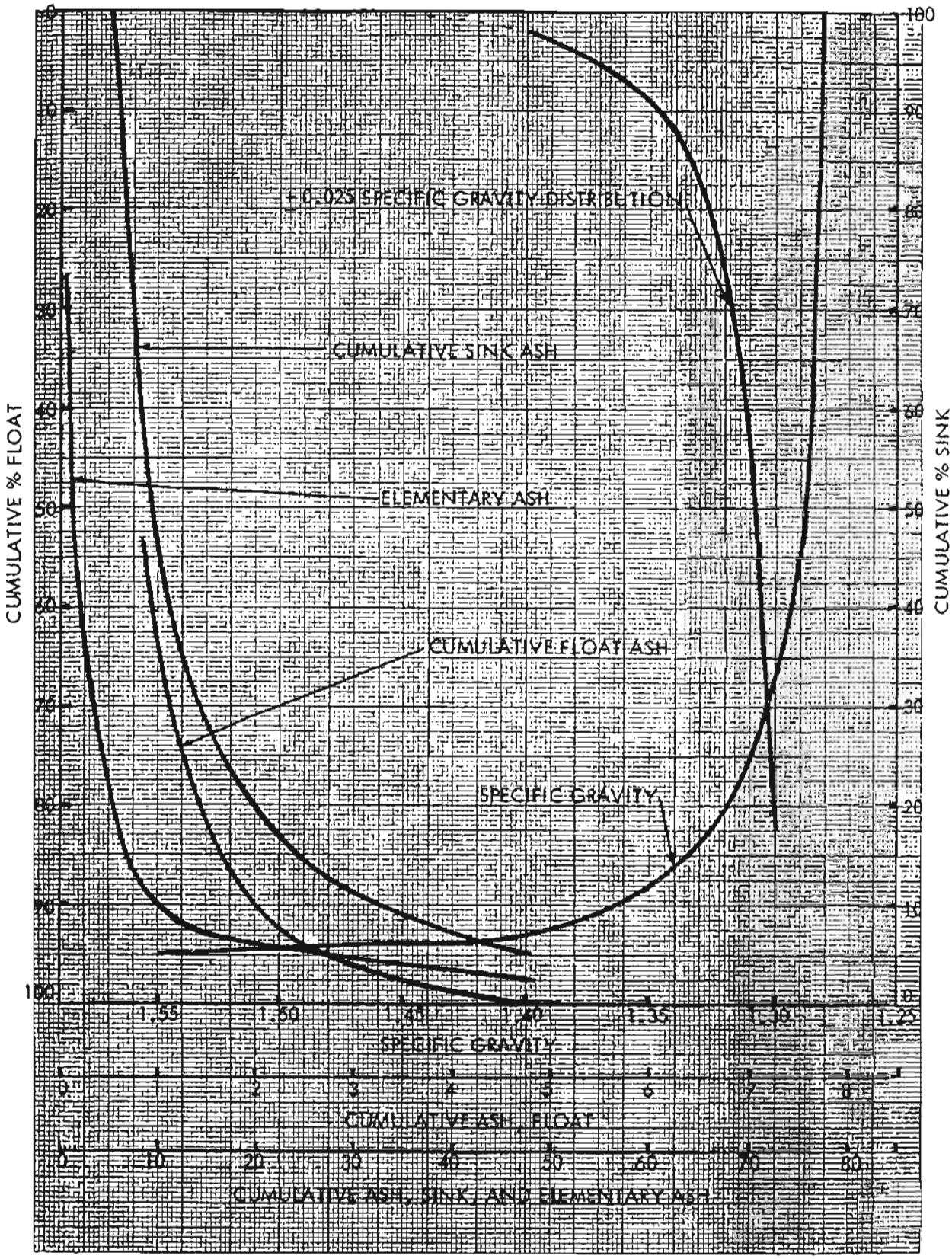

FIGURE 6 - WASHABILITY CHARACTERISTICS OF 0.525" x 35 MESH SIZE COAL, LEEPER CREEK NO. 1, BERING RIVER FIELD

TABLE 9

SINK-FLOAT RESULTS OF 0.525" x 3 MESH SIZE COAL,
LEEPER CREEK NO. 2, BERING RIVER FIELD
(17.53% of Raw Coal)

Specific Gravity		Actual Products		Cumulative Float		Cumulative Sink		+0.025 Sp.G.
Sink	Float	Wt., %	Ash, %	Wt., %	Ash, %	Wt., %	Ash, %	Material, %
	1.290	63.98	0.84	63.98	0.84	100.00	2.05	
1.290	1.300	21.14	1.92	85.12	1.11	36.02	4.19	94.73
1.300	1.325	9.61	3.42	94.73	1.34	14.88	7.42	12.20
1.325	1.350	2.59	6.45	97.32	1.48	5.27	14.72	3.59
1.350	1.375	1.00	9.26	98.32	1.56	2.68	22.73	1.35
1.375	1.400	0.35	11.13	98.67	1.59	1.68	30.74	.53
1.400	1.450	0.37	15.27	99.04	1.64	1.33	35.88	-
1.450	1.500	0.15	19.23	99.19	1.67	0.96	43.85	-
1.500	1.550	0.05	23.32	99.24	1.68	0.81	48.36	-
1.550		0.76	50.05	100.00	2.05	0.76	50.05	-
Total		100.00	2.05					

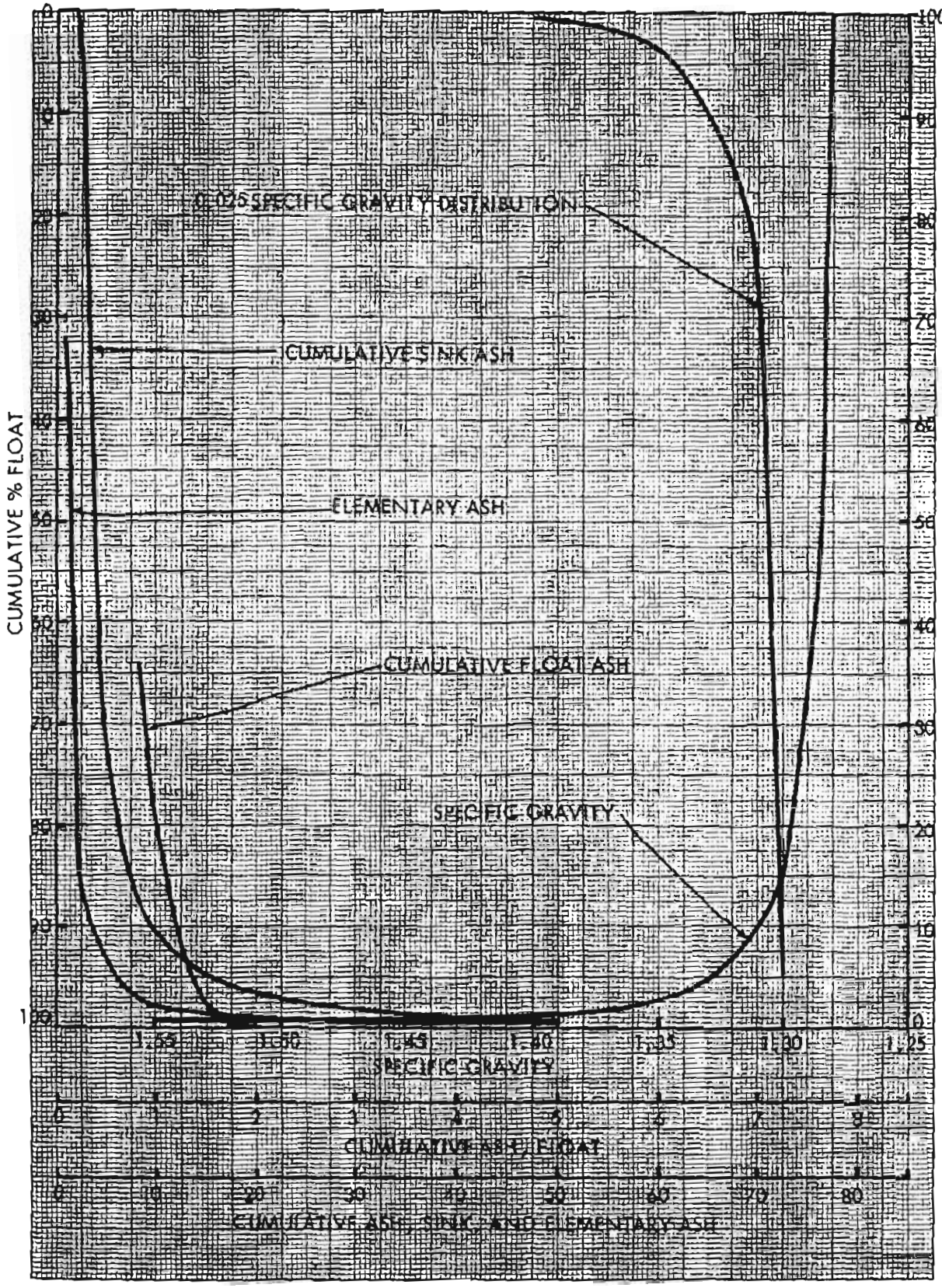

FIGURE 7 - WASHABILITY CHARACTERISTICS OF 0.525" x 3 MESH SIZE COAL, LEEPER CREEK NO. 2, BERING RIVER FIELD

TABLE 10

SINK-FLOAT RESULTS OF 3 x 6 MESH SIZE COAL,
LEEPER CREEK NO. 2, BERING RIVER FIELD
(23.09% of Raw Coal)

Specific Gravity		Actual Products		Cumulative Float		Cumulative Sink		+0.025 Sp. G.
Sink	Float	Wt., %	Ash, %	Wt., %	Ash, %	Wt., %	Ash, %	Material, %
	1.290	62.64	0.76	62.64	0.76	100.00	2.10	
1.290	1.300	22.49	2.06	85.13	1.10	37.36	4.36	94.41
1.300	1.325	9.28	3.43	94.41	1.33	14.87	7.84	11.94
1.325	1.350	2.66	6.23	97.07	1.47	5.59	15.15	3.52
1.350	1.375	0.86	9.53	97.93	1.54	2.93	23.26	1.36
1.375	1.400	0.50	11.98	98.43	1.59	2.07	28.98	0.72
1.400	1.450	0.44	16.67	98.87	1.66	1.57	34.39	-
1.450	1.500	0.23	21.88	99.10	1.70	1.13	41.34	-
1.500	1.550	0.11	26.53	99.21	1.73	0.40	46.50	-
1.550		0.79	49.24	100.00	2.10	0.79	49.24	-
	Total	100.00	2.10					

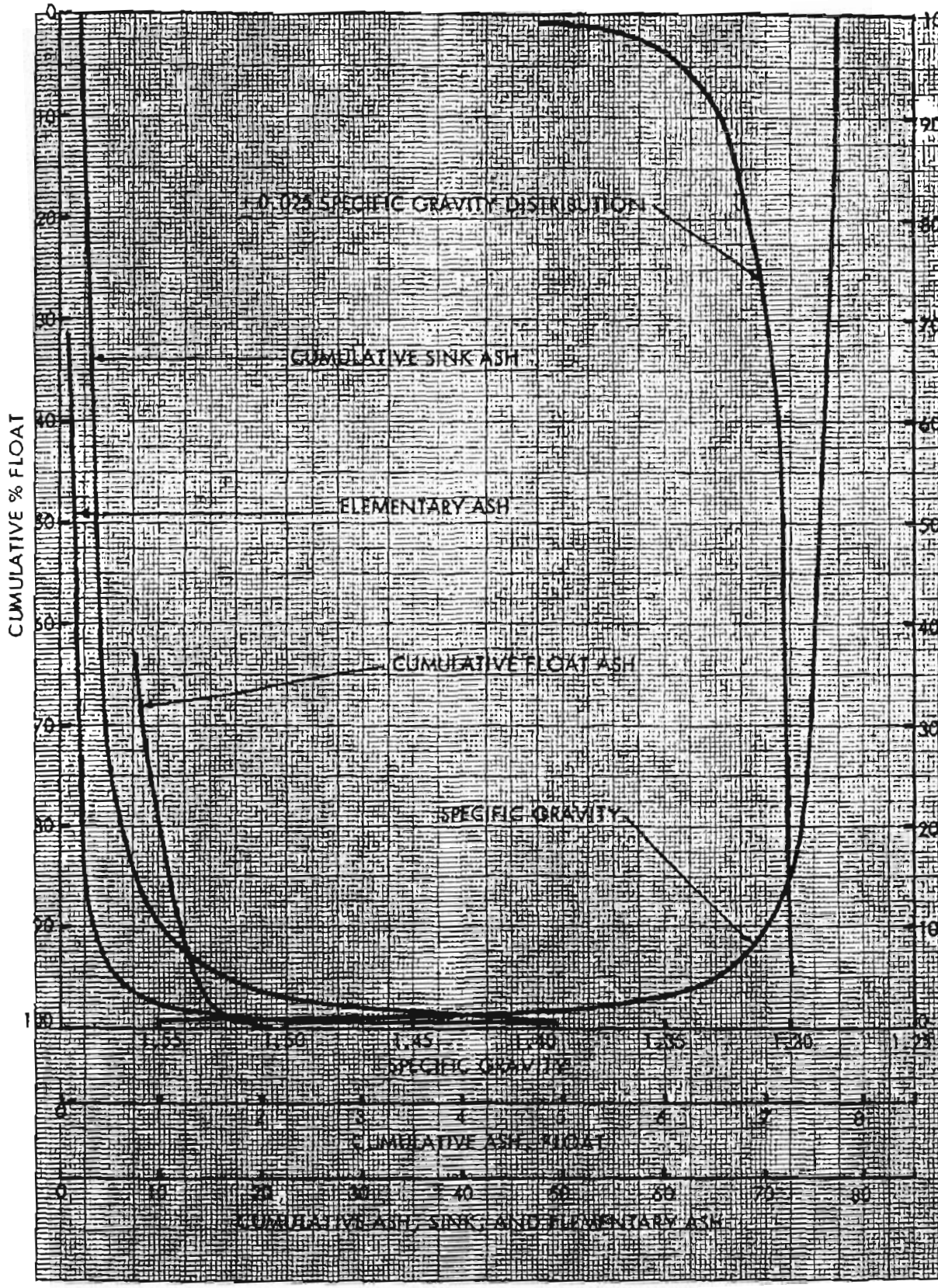

FIGURE 8 - WASHABILITY CHARACTERISTICS OF 3 x 6 MESH SIZE COAL, LEEPER CREEK NO. 2, BERING RIVER FIELD

TABLE 11

SINK-FLOAT RESULTS OF 6 x 10 MESH SIZE COAL,
LEEPER CREEK NO. 2, BERING RIVER FIELD
(21.03% of Raw Coal)

Specific Gravity		Actual Products		Cumulative Float		Cumulative Sink		+0.025 Sp. G.
Sink	Float	Wt., %	Ash, %	Wt., %	Ash, %	Wt., %	Ash, %	Material, %
	1.290	63.23	0.72	63.23	0.72	100.00	2.42	
1.290	1.300	20.82	1.96	84.05	1.03	36.77	5.35	93.18
1.300	1.325	9.13	3.48	93.18	1.27	15.95	9.78	11.66
1.325	1.350	2.53	6.32	95.71	1.40	6.82	18.22	3.81
1.350	1.375	1.28	9.17	96.99	1.50	4.29	25.24	1.97
1.375	1.400	0.69	11.88	97.68	1.58	3.01	32.07	0.99
1.400	1.450	0.60	15.53	98.28	1.66	2.32	38.07	-
1.450	1.500	0.30	21.40	98.58	1.72	1.72	47.92	-
1.500	1.550	0.19	26.89	98.77	1.77	1.42	51.08	-
1.550		1.23	54.82	100.00	2.42	1.23	54.82	-
Total		100.00	2.42					

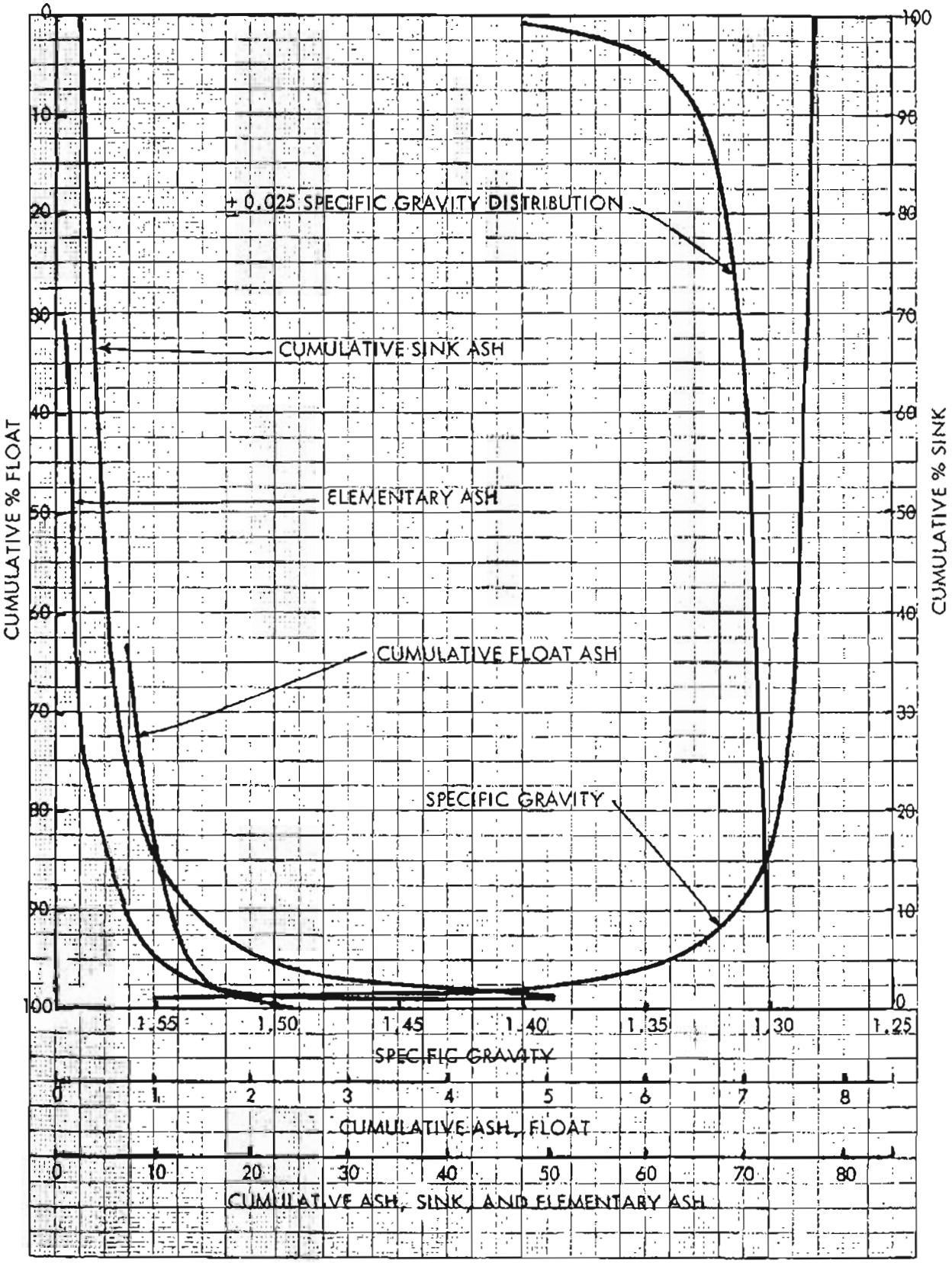

FIGURE 9 - WASHABILITY CHARACTERISTICS OF 6 x 10 MESH SIZE COAL, LEEPER CREEK NO. 2, BERING RIVER FIELD

TABLE 12

SINK-FLOAT RESULTS OF 10 x 20 MESH SIZE COAL,
LEEPER CREEK NO. 2, BERING RIVER FIELD
(15.16% of Raw Coal)

Specific Gravity		Actual Products		Cumulative Float		Cumulative Sink		+0.025 Sp. G.
Sink	Float	Wt., %	Ash, %	Wt., %	Ash, %	Wt., %	Ash, %	Material, %
	1.290	67.23	0.69	67.23	0.69	100.00	3.29	
1.290	1.300	15.59	2.05	82.82	0.95	32.77	8.62	90.54
1.300	1.325	7.72	4.13	90.54	1.22	17.18	14.59	10.87
1.325	1.350	3.14	5.45	93.68	1.36	9.46	23.12	4.65
1.350	1.375	1.51	8.38	95.19	1.47	6.32	31.90	2.34
1.375	1.400	0.83	10.72	96.02	1.55	4.81	39.28	1.29
1.400	1.450	0.92	14.25	96.94	1.67	3.98	45.25	-
1.450	1.500	0.37	21.51	97.31	1.75	3.06	54.54	-
1.500	1.550	0.23	27.33	97.54	1.81	2.69	59.07	-
1.550		2.46	62.05	100.00	3.29	2.46	62.05	-
Total		100.00	3.29					

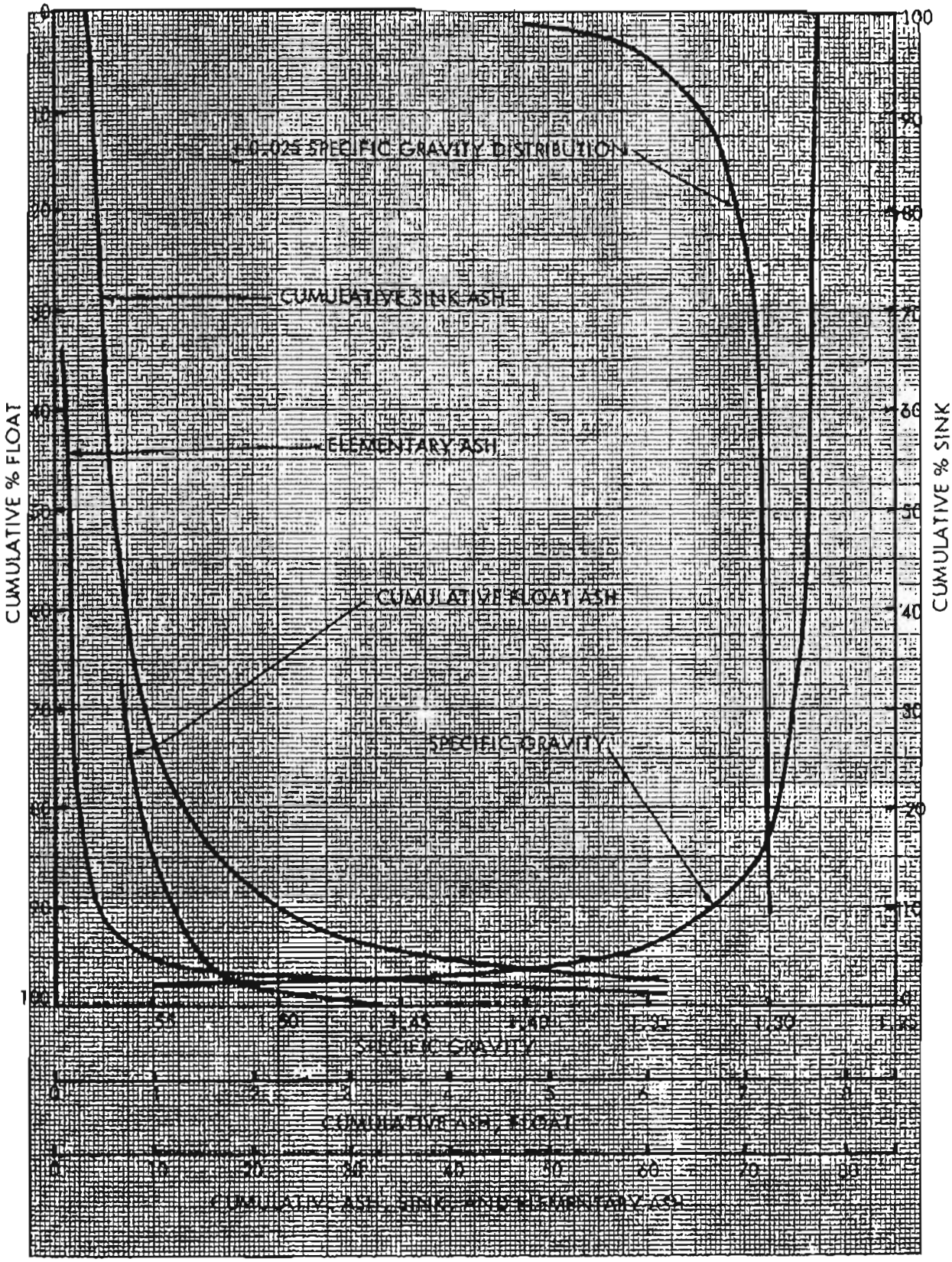

FIGURE 10 - WASHABILITY CHARACTERISTICS OF 10 x 20 MESH SIZF COAL, LEEPER CREEK NO. 2, BERING RIVER FIELD

TABLE 13

SINK-FLOAT RESULTS OF 20 x 35 MESH SIZE COAL,
LEEPER CREEK NO. 2, BERING RIVER FIELD
(10.66% of Raw Coal)

Specific Gravity		Actual Products		Cumulative Float		Cumulative Sink		+0.025 Sp. G.
Sink	Float	Wt., %	Ash, %	Wt., %	Ash, %	Wt., %	Ash, %	Material, %
	1.290	70.76	0.65	70.76	0.65	100.00	4.22	
1.290	1.300	10.81	2.03	81.57	0.87	29.24	12.85	88.16
1.300	1.325	6.59	3.59	88.16	1.04	18.43	19.19	10.06
1.325	1.350	3.47	5.56	91.63	1.21	11.84	27.89	5.19
1.350	1.375	1.72	8.03	93.35	1.34	8.37	37.15	2.63
1.375	1.400	0.91	10.28	94.26	1.42	6.65	44.66	1.45
1.400	1.450	1.07	13.28	95.26	1.56	5.74	50.11	-
1.450	1.500	0.43	20.79	95.76	1.64	4.67	58.54	-
1.500	1.550	0.24	26.42	96.00	1.70	4.24	62.38	-
1.550		4.00	64.58	100.00	4.22	4.00	64.58	-
	Total	100.00	4.22					

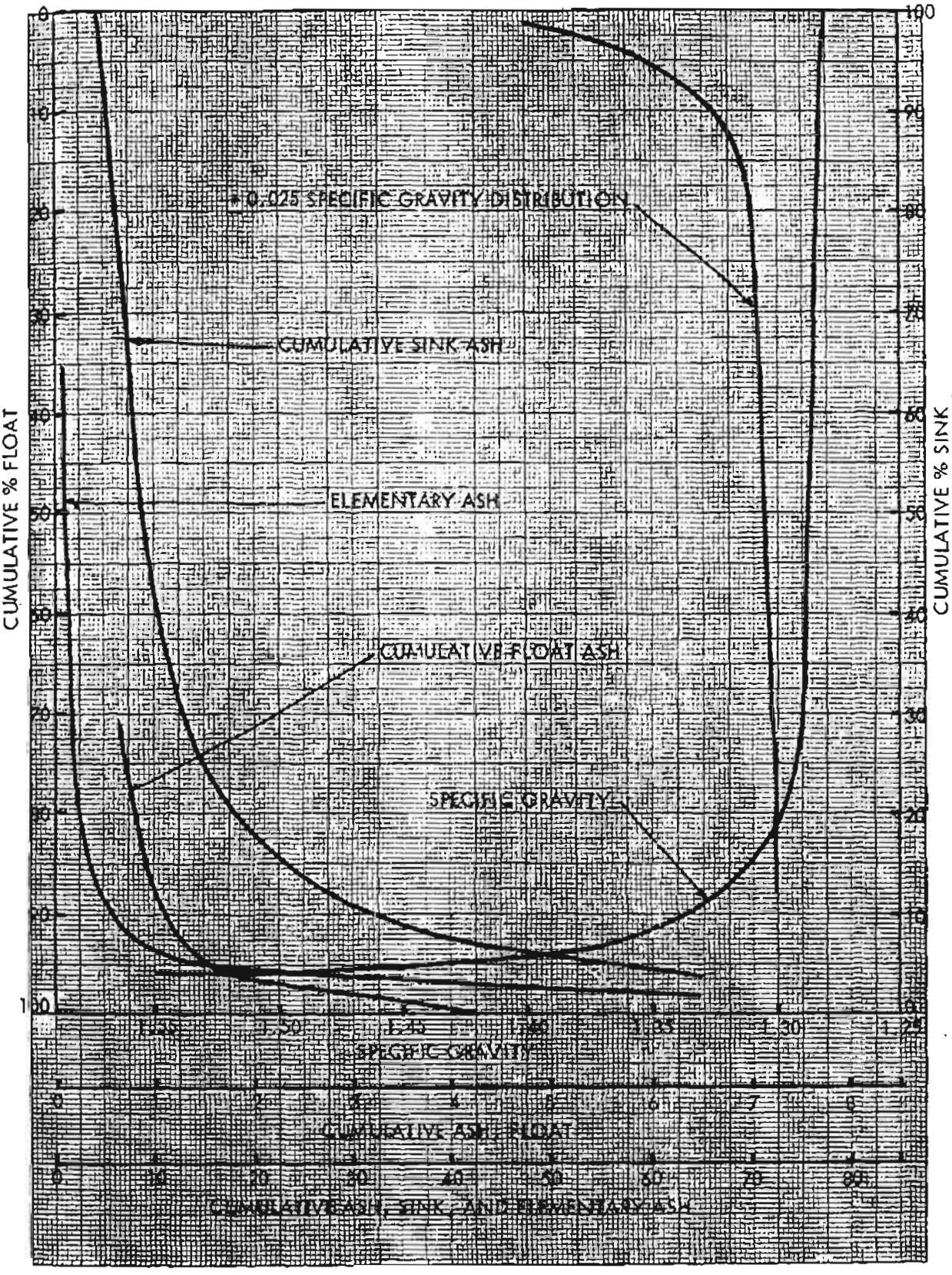

FIGURE 11 - WASHABILITY CHARACTERISTICS OF 20 x 35 MESH SIZE COAL, LEEPER CREEK NO. 2, BERING RIVER FIELD

TABLE 14

SINK-FLOAT RESULTS OF 0.525" x 35 MESH SIZE COAL,
LEEPER CREEK NO. 2, BERING RIVER FIELD
(87.47% of Raw Coal)

Specific Gravity		Actual Products		Cumulative Float		Cumulative Sink		+0.025 Sp. G.
Sink	Float	Wt., %	Ash, %	Wt., %	Ash, %	Wt., %	Ash, %	Material, %
	1.290	64.83	0.74	64.83	0.74	100.00	2.63	
1.290	1.300	19.20	2.00	84.03	1.03	35.17	6.12	92.74
1.300	1.325	8.71	3.56	92.74	1.27	15.97	11.08	11.51
1.325	1.350	2.80	6.04	95.54	1.41	7.26	20.12	4.01
1.350	1.375	1.21	8.88	96.75	1.50	4.46	28.96	1.83
1.375	1.400	0.62	11.26	97.37	1.56	3.25	36.41	0.93
1.400	1.450	0.62	14.92	97.99	1.65	2.63	42.36	-
1.450	1.500	0.28	21.03	98.27	1.70	2.01	50.91	-
1.500	1.550	0.16	26.61	98.43	1.74	1.73	55.75	-
1.550		1.57	58.61	100.00	2.63	1.57	58.61	-
Total		100.00	2.63					

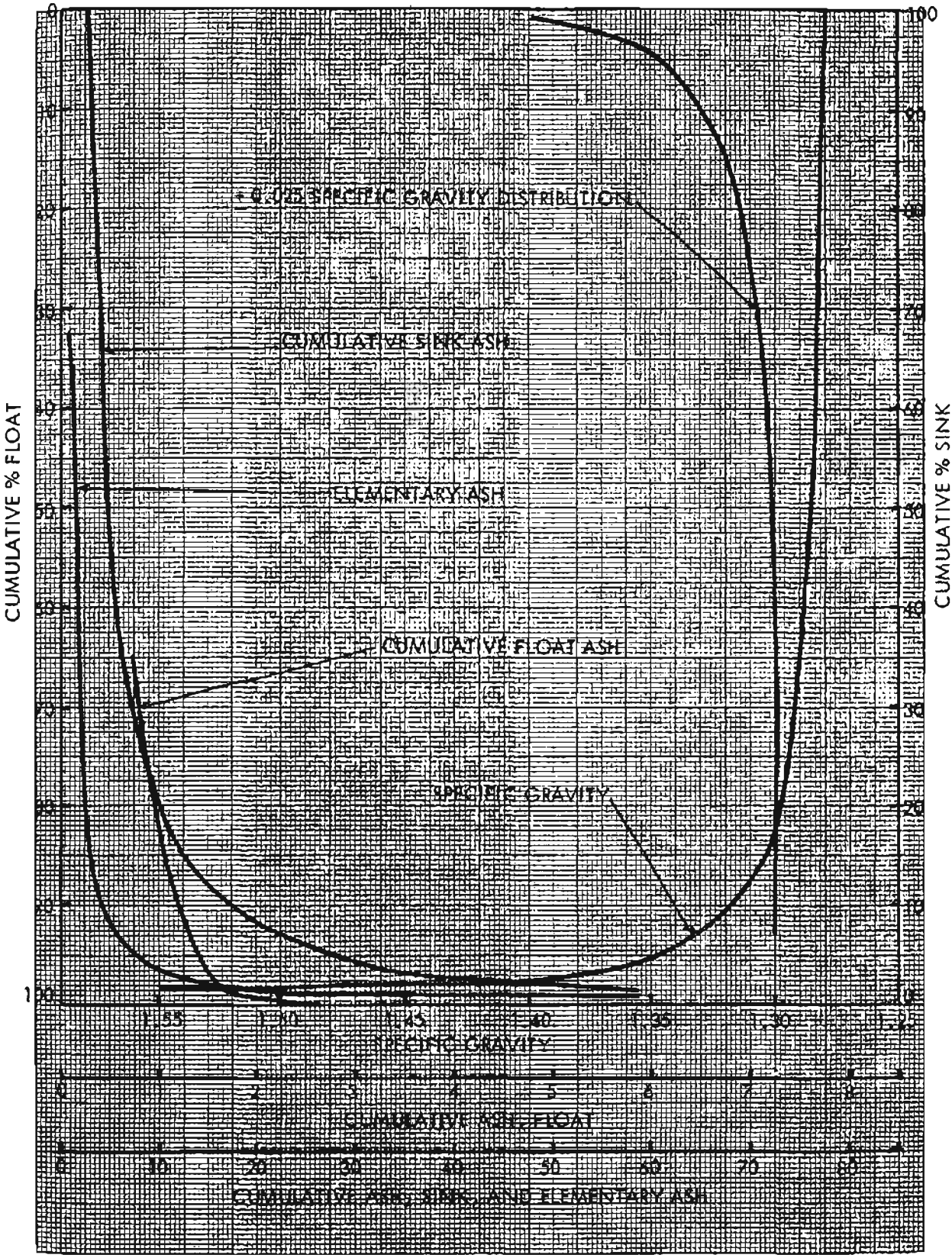

FIGURE 12 - WASHABILITY CHARACTERISTICS OF 0.525" x 35 MESH SIZE COAL, LEEPER CREEK NO. 2, BERING RIVER FIELD

TABLE 15

PROXIMATE ANALYSIS OF RAW COAL
AND 1.29 SP.G. FLOAT SAMPLES

Coal	Basis	Bed Moisture* %	Ash %	Sulfur %	Volatile Matter %	Fixed Carbon %	Heating Value Btu	Free Swelling Index
Raw Coal	1	1.45	6.00	1.22	14.66	77.89	14,586	
Leeper Creek	2	-	6.09	1.24	14.88	79.03	14,801	2½
No. 1	3	-	-	1.32	15.85	84.15	15,759	
	4	-	-	-	-	-	15,690	
Raw Coal	1	1.71	2.72	0.78	13.96	81.61	15,041	
Leeper Creek	2	-	2.77	0.79	14.20	83.03	15,303	2
No. 2	3	-	-	0.82	14.61	85.39	15,739	
	4	-	-	-	-	-	15,680	
0.525" x 35 Mesh	1	1.86	0.82	0.70	14.91	82.41	15,346	
1.29 Sp.G. Floats	2	-	0.83	0.71	15.19	83.98	15,637	3½
Leeper Creek	3	-	-	0.72	15.32	84.68	15,768	
No. 1	4	-	-	-	-	-	15,735	
0.525" x 35 Mesh	1	1.66	0.73	0.70	14.15	83.46	15,401	
1.29 Sp.G. Floats	2	-	0.74	0.71	14.39	84.87	15,661	3
Leeper Creek	3	-	-	0.72	14.49	85.51	15,777	
No. 2	4	-	-	-	-	-	15,750	

*Equilibrated Bed Moisture

1. Bed moisture basis
2. Dry basis
3. Moisture and ash free basis
4. Moist ash free basis